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ABSTRACT

This paper reports on the development and extension of a concept mapping tool into a complete online course design support framework for academics: CEDOT (Course Elicitation, Development and Output Tool). The tool provides a course design framework that faculty work through in an order of their choosing. It gives context specific help and advice that will enable them to complete all the required elements. As well as taking them through the course design process and creating a document that adheres to a university-defined format, at its core is a concept mapping and navigation tool to plan and structure the relationship between the various course elements, processes and resources. The course design framework outlined in this paper applies to Web based courses and to courses designed to be delivered "conventionally" through face-to-face teaching or through mixed modes of delivery. A key feature of CEDOT is that at any time during the course development process the thinking and work carried out so far can be made available via the Web to other academics associated with the course. They can comment on the course structure so far developed and their input can be incorporated into revised versions. CEDOT will output documentation associated with the course in various formats, exploiting the potential of XML according to the needs of identified groups. This includes information for course administrators and validation/approval committees and information for the student handbook and course guides. The tool is more than a documentation framework; it also enables the publishing of the course resources onto the Web implementing the navigational structure as developed in the concept map element of the tool. This Web structure may be in outline form, i.e. a navigational structure is in place with descriptors of the course content for further development or if appropriate, a fully functioning and complete version of the course resources may be output. Another key feature of CEDOT is its use of XML so that outputs can be customized according to the needs of different groups. CEDOT will also conform to emerging standards for learning architectures. (Contains 11 references.) (AEF)

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Supporting Faculty in the Design and Structuring of Web-based Courses

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Abstract: this paper reports on the development of CEDOT, a tool to support academics in the collaborative and iterative planning, development, creation and delivery of courses. It provides an environment for the conceptualisation and structuring of the different elements of the teaching and learning process situated in a supportive framework. CEDOT output is in XML, and includes both documentation and web-based courseware.

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Introduction

> *"The really truly hard part to web-based course design is in content design. A reasonably competent computer professional can provide chat facilities, threaded discussion lists, web pages, on-line registration, etc. But the core of on-line course materials will have to be determined by experts in the field working with experts in distance education delivery."* (Downs)[1]

This paper will discuss the development and extension of an existing concept mapping tool (Webmapper)[2] into a complete on-line course design support framework for academics – CEDOT, Course Elicitation, Development and Output Tool.

The tool provides a course design framework that faculty staff work through in an order of their choosing. It gives context specific help and advice that will enable them to complete all the required elements. But as well as taking them through the course design process and creating a document that adheres to a university-defined format[3], at its core is a concept mapping and navigation tool to plan and structure the relationship between the various course elements, processes and resources. The course design framework outlined here applies to web based courses and to courses designed to be delivered "conventionally" through face-to face teaching or through mixed modes of delivery.

A key feature of CEDOT is that at any time during the course development process the thinking and work carried out so far can be made available via the Web to other academics associated with the course. They can comment on the course structure so far developed and their input can be incorporated into revised versions.

CEDOT will output documentation associated with the course in various formats, exploiting the potential of XML according to the needs of identified groups. This includes information for course administrators and validation/approval committees and information for the student handbook and course guides.

The tool is more than a documentation framework, it also enables the publishing of the course resources onto the Web implementing the navigational structure as developed in the concept map element of the tool. This web structure may be in outline form, i.e a navigational structure is in place with descriptors of the course content for further development or if appropriate, a fully functioning and complete version of the course resources may be output.

A key feature of CEDOT is its use of XML so that outputs can be customised according to the needs of different groups. CEDOT will also conform to emerging standards for learning architectures e.g. the IMS specifications[4].

The need for such a tool

The authors have been involved in a range of projects linked to the design, development and embedding of resource based learning, and in particular Web-based learning and teaching in UK universities[5]. It is clear from this experience and our knowledge of the literature that faculty staff require help and support in the design of appropriate learning materials especially those that take full advantage offered by Web-based learning. While other tools have been successfully deployed that provide guidance and a framework for developing Web-based

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courseware, we are not aware of any tool that also provides validated XML output, prototyping and development support in one package.

In a recent symposium of recognised experts in learning technology it was noted that:

> "Frequently, one assumes that university faculty have an understanding of learning theory simply because they are teachers. In reality, many are exposed to these ideas for the first time during faculty development experiences. Through working in partnership with instructional designers, faculty can become knowledgeable about learning theory and its relationship to course design."[6]

It is a feature of our (and many other) institutions that this level of instructional design support is not routinely available. CEDOT is designed to go some way to address this situation by providing online context based help to guide and support to guide academics one through the course design process and then publish their outputs in appropriate formats

An example of such a support framework is the Teaching for Understanding Framework [7]. The Teaching for Understanding (TFU) framework helps educators to:

- formulate generative curriculum topics,
- define specific educational goals,
- design performances to help students develop and demonstrate understanding and,
- integrate ongoing assessment of student performances to monitor and promote learning.

A similar tool for supporting the process is that provided by MERLIN[8], developed at the Northern Alberta Institute of Technology, Canada. This is a web-based curriculum development tool that adheres to NAIT's guidelines for its in-house Learning Outcome Guide for module development.

In developing CEDOT we wished to produce a framework that enabled staff to work through key elements of the instructional design process in a guided and supported manner while at the same time not being constrained to work through this process in a fixed given order. It is important to support the flexibility and range of modes of development that are typically found in the course planning process so that faculty staff can work in ways in which they are comfortable. Some academics for example adopt a strong top down approach, developing the overall structure, learning outcomes and pedagogical strategy before defining course content. In other cases academics have a model of the overall structure in their head and wish to flesh out elements of the content before finalising the overall structure.

CEDOT is designed to accommodate these approaches. It provides a graphical environment in which the course design process is modelled and from which output both in terms of course documentation and linked Web-based course resources are produced.

The course design model

The course design model on which it is based is represented in the work of Scott[9]. Figure 1 (below) represents the underlying conceptualisation of the course design process used in CEDOT.

Guidance to staff

Whilst working through CEDOT, onscreen context sensitive advice and guidance is available. This is in the form of brief notes linked to Acrobat PDF format documents that provide more detailed explanation and commentary. These are available for viewing onscreen but users are advised to refer to a referenced printed version while working through the software for ease of use.

The key elements of advice and support that exist in CEDOT are:

- guidance on identification of key characteristics of potential students,
- analysis of the relation of the proposed new course to existing courses both in terms of pre requisites and exit outcomes.
- guidance on the development of learning outcomes,
- knowledge and task analysis to elicit course content and structure,

- advice on the identification of student support needs and the student support strategy,
- advice on the identification and specification of assessment elements, identification of teaching strategies to be employed,
- advice on the methods and approaches to course evaluation,
- support in the planning and structuring of course resources and materials

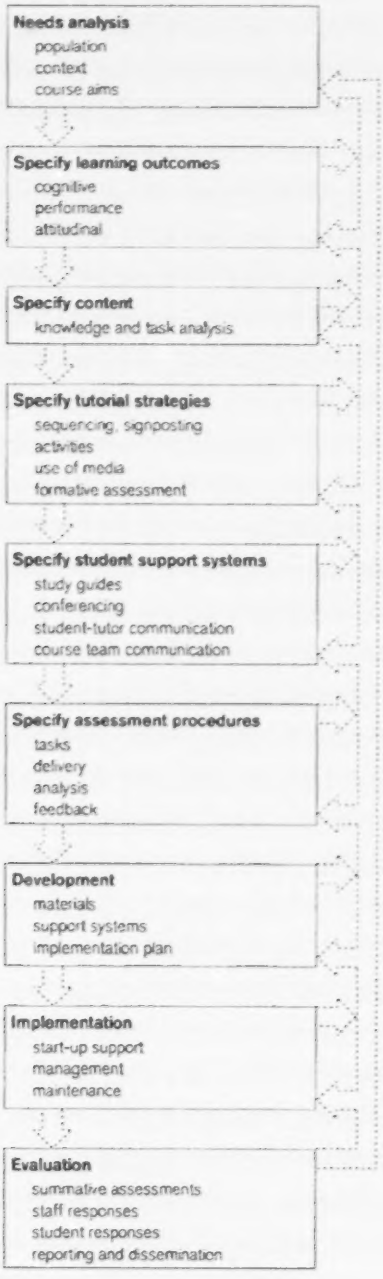

Figure 1. The course design process

Course development in practice
Such models of course design may in practice be far removed from the way in which faculty staff do engage in the process of course creation. In reality course development is a much more fluid, "messy" process. An individual academic may, for example, having in general terms outlined the course structure, concentrate in some detail on one particular element. In another case it may be appropriate to incorporate materials and ideas that have already been developed elsewhere. Issues relating to the assessment system or the best way of providing targeted student support may be the most important concerns at a particular time. CEDOT can capture the ebb and flow of this creative process. It accommodates the building up and sequencing of different elements in a variety of ways so the user will not feel constrained to develop a course in a way that does not suit their own particular approach.

Collaborative roles
We have argued elsewhere[10] that courseware is best developed in a team context, whereby individuals with a range of skills (subject experts, instructional designers, programmers) work together to agreed aims and objectives in the development of a project.

The development of powerful web authoring tools, and tools for the conversion of word processed documents into HTML format can tend to encourage the collapse of these various roles into one person - the universal courseware expert. When using such tools there is a tendency not to map out the courseware first, but in the act of marking up, to try to structure it at the same time. In effect, what happens is that the producer is both attempting to structure and plan the courseware and produce it simultaneously and in the process of so doing may lose sight of the main pedagogic structures and navigational routes.

CEDOT is designed to support interaction and collaboration. At any time the concept map and the associated documentation can be published so that other course team members can comment on it and their ideas be incorporated into the course design. The prototype facility allows a version of the course to the output on the Web and used so that other members of the team can comment on its navigational structure and other features.

The development of CEDOT
This has involved three, interconnected strands of activity.

First, it required work with academics to understand how they develop course materials and to identify particular issues and to specify a tool that addresses these issues

The second element is to design an effective and transparent interface and navigation system which enables course designers to easily 'toggle' between the stages of the course design process, content development and navigational structures.

The third is to explore the capabilities of XML as a way of

- orchestrating data and its characteristics appropriate to this use so that written documentation appropriate to different groups may be produced and that this documentation when aggregated across a range of course can be further interrogated in order for example to produce summative reports.
- facilitating the creation of course resources from CEDOT either at the level of a *prototype mode*, a *delivery mode* or a *simple documentation mode*.

An overview of the software
The technology
The current development has two strands: a programmer is creating a Java-based implementation, and one of the authors (H Freeman) is creating a version in Revolution (a variant of MetaCard[11]) that can be delivered as an executable on Macintosh, Windows and Unix platforms. Revolution is a graphical application development and multimedia authoring package for Windows 95/98/NT/2000, UNIX/X11 workstations, Linux and MacOS. The database behind both implementations is FileMaker Pro v5 (unlimited) running on a Macintosh G4 server although other databases could be used.

CEDOT in action
The Main Menu outlines the stages of course design at a general level as developed from figure 1. Selecting these menu items opens a further window with fields for text entry relating to sub topics.

A key feature of CEDOT is that it provides a visual environment in which the process of course development occurs. Building on the original Webmapper[1], a concept map of a course is created consisting of nodes that can be linked together and which in the final output represent sequences or clusters of Web pages.

Double-clicking a node opens a separate window that enables content to be described or created in the context of all of the headings in the main menu. Certain fields eg those relating to learning outcomes will be populated with text (if entered) from the main learning outcome menu.

At all stages textual entries are guided by on-line guidance and textual clues. In particular, the creation of learning outcomes is supported by lists of approved verb and compound verb lists obtained from the literature.

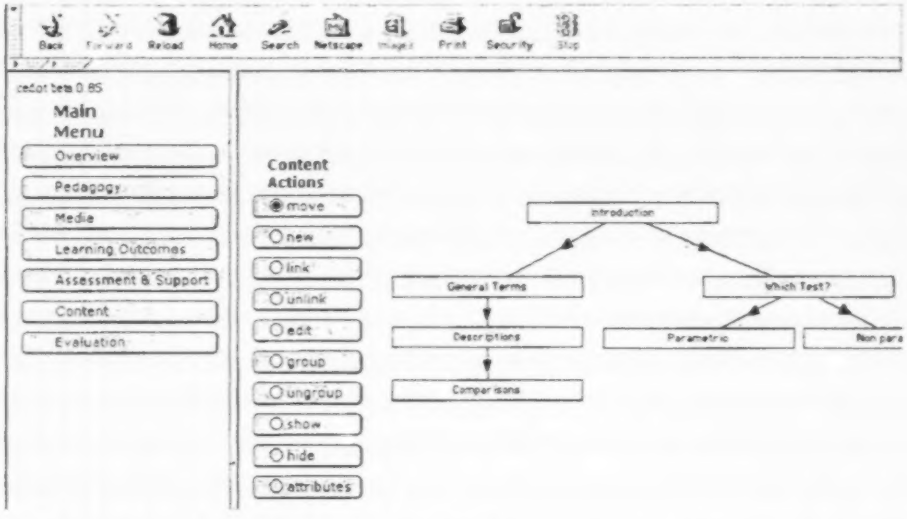

Figure 2. A browser view of the Java version of CEDOT in concept-mapping mode.

Selecting one of the items in the Main Menu allows a top-down approach to be taken to module development, whereas the concept-map approach enables a more granular, content-focused approach. Whilst it is possible to begin the design at the top level, the map must be used at some point. However, the reverse is not necessarily true, because groups of nodes may be allocated to a learning outcome, to an assessment instrument and to a resource requirement (such as a lecture room or a laboratory).

During development all changes are held within the server-based database. At any time during development a report can be generated that compares the structure of the working document against the University's module template DTD for compliance. Once this is satisfied an XML file is created for storage centrally. Further development to this software will focus on the integration of many module descriptions into a full course curriculum description.

Outputs from CEDOT

The outputs of the system include:

- documentation that describes the course and its various components,
- documentation that logs the process of course creation and development,
- a report on the degree of compliance between the current structure and the University's definition of a module template,
- a web deliverable that consists of a fully linked site but contains only node descriptions,
- a web deliverable that consists of a fully linked site and contains all content and linked graphics, applets etc
- The automatic generation of course guides, student handbooks and similar documentation that can be distributed to students.
- Version control throughout the development process and for the creation of new instances of the course design for future use.

These outputs are in XML or ASCII text, and we assume the development of both university wide systems that employ XML for data interchange and the existence of XML web browsers. The power of XML to enable the interchange, re-ordering and re-configuration of data will be of particular significance as substantial numbers of curriculum descriptions are generated.

CEDOT is addressing real academic needs in a way that will help faculty to design courses in a more collaborative, transparent and supported environment.

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[3] De Montfort University, 2000. Developing a module template (internal document)
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[10] Ryan S, Scott B, Freeman H, Patel D, *The Virtual University: The Internet and Resource-Based Learning* Kogan Page Ltd; Chapter 5, ISBN: 0749425083
[11] Runtime Revolution Limited, Edinburgh, Scotland. http://www.runrev.com

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